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INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

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| Applicant's or agent's file reference 216 | FOR FURTHER ACTION | See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416) |
| International application No. PCT/KR 2004/001092 | International filing date (day/month/year) 12 May 2004 (12.05.2004) | Priority Date (day/month/year) 1 December 2003 (01.12.2003) |
| International Patent Classification (IPC) or national classification and IPC IPC⁸: H01L 21/312 (2006.01); C09D 183/06 (2006.01) | | |
| Applicant SOGANG UNIVERSITY CORPORATION | | |

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| <p>1. This international preliminary examination report has been prepared by this International Preliminary Examination Authority and is transmitted to the applicant according to Article 36.</p> <p>2. This REPORT consists of a total of <u>3</u> sheets, including this cover sheet.</p> <p><input checked="" type="checkbox"/> This report is also accompanied by ANNEXES, i.e., sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).</p> <p>These annexes consist of a total of <u>1</u> sheets.</p> <p>3. This report contains indications relating to the following items:</p> <ul style="list-style-type: none"> I. <input checked="" type="checkbox"/> Basis of the opinion II. <input type="checkbox"/> Priority III. <input type="checkbox"/> Non-establishment of opinion with regard to novelty, inventive step and industrial applicability IV. <input type="checkbox"/> Lack of unity of invention V. <input checked="" type="checkbox"/> Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement VI. <input type="checkbox"/> Certain documents cited VII. <input type="checkbox"/> Certain defects in the international application VIII. <input type="checkbox"/> Certain observations on the international application |
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| Date of submission of the demand 28 June 2005 (28.06.2005) | Date of completion of this report 14 March 2006 (14.03.2006) |
| Name and mailing address of the IPEA/AT Austrian Patent Office Dresdner Straße 87 A-1200 Vienna Facsimile No. 1/53424/200 | Authorized officer HARASEK S. Telephone No. 1/53424/574 |

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.

PCT/KR 2004/001092

I. Basis of the report

1. With regard to the elements of the international application:*

 the international application as originally filed the description:
pages 2-15, as originally filed
pages 1, filed with the demand
pages _____, filed with the letter of _____. the claims:
pages 16, 17, as originally filed
pages _____, as amended (together with any statement) under Article 19
pages _____, filed with the demand
pages _____, filed with the letter of _____. the drawings:
pages 1, as originally filed
pages _____, filed with the demand
pages _____, filed with the letter of _____. the sequence listing part of the description:
pages _____, as originally filed
pages _____, filed with the demand
pages _____, filed with the letter of _____.

2. With regard to the language, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language English which is: the language of a translation furnished for the purposes of international search (under Rule 23.1(b)). the language of publication of the international application (under Rule 48.3(b)). the language of the translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any nucleotide and/or amino acid sequence disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

 contained in the international application in printed form. filed together with the international application in computer readable form. furnished subsequently to this Authority in written form. furnished subsequently to this Authority in computer readable form. The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished. The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.4. The amendments have resulted in the cancellation of: the description, pages _____. the claims, Nos. _____. the drawings, sheets/fig _____.5. This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).**

* Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as „originally filed“ and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17).

** Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

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| <p>International application No. PCT/KR 2004/001092</p> |
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| V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement | |
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| 1. Statement Novelty (N) Claims 1-7 | | YES | |
| | | Claims ---- | NO |
| Inventive step (IS) Claims 1-7 | | YES | |
| | | Claims ---- | NO |
| Industrial applicability (IA) Claims 1-7 | | YES | |
| | | Claims ---- | NO |

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| Citations and explanations (Rule 70.7) |
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The following documents have been cited in the International Search Report:

D1: JP 2000328004 A
 D2: JP 8143818 A
 D3: US 6204202 B1
 D4: JP 5315319 A

The cited documents deal with dielectric thin films and methods for their preparation.

The cited documents do not anticipate the combinations of technical features of the present claims, neither taken alone nor in combination. Therefore, based on the results of the International Search the subject-matter of claims 1-7 is considered to be novel and involving an inventive step.

It shall be mentioned that the International Search Report has not been established by this authority acting as the International Preliminary Examining Authority.

28 JUNE 2005

ULTRA-LOW DIELECTRICS FILM FOR COPPER INTERCONNECT

BACKGROUND OF THE INVENTION

FIELD OF THE INVENTION

5 The present invention relates to an ultra-low dielectric film for a copper interconnect, in particular, to an porous film prepared by coating with an organic solution containing a polyalkyl silsesquioxane precursor or its copolymer as a matrix and acetylcyclodextrin nanoparticles as a template and followed by performing a sol-gel reaction and heat treatment at higher temperature. The 10 present films may contain the template of up to 60 vol%, which is due to the selective use of acetylcyclodextrin, and have homogeneously distributed pores with the size of no more than 5 nm in the matrix. In addition, the present films exhibit an ultra low dielectric constant of about 1.5, and well-defined closed pores, so that thus being considered as a good ultra-low dielectric film for a copper 15 interconnect.

DESCRIPTION OF THE RELATED ART

Due to the recent request for semiconductors to have the properties of high integration and high speed, the critical dimension is on the drastic decrease. Low 20 dielectrics, fabricated with aluminum liner and silicone oxide membrane (SiO_2 , $k=4.0$) and fluoro-silicone oxide membrane ($k=3.5$) as interlayer dielectrics, have been recognized as an excellent semiconductor device having high integration and high performance. However, such low dielectrics show serious shortcomings that signal delay due to delay of RC [expressed as multiplying a resistance (R) of a liner